CLAIMS

We claim:

1. A network comprising:

a plurality of subscriber units to communicate with the base station using an orthogonal frequency-division multiple-access (OFDMA) protocol; and

a base station including

a memory to store broadband spatial signature vectors associated with each subscriber, the vectors being a function of frequency; and

traffic channel allocation logic to allocate OFDMA channels using the broadband spatial signature vectors of the subscribers.

2. The network defined in Claim 1 wherein the broadband spatial signature vectors are indicative of fading and spatial characteristics of the subscribers.

3. The network defined in Claim 1 wherein at least one of the spatial signature vectors is indicative of channel fading conditions of a new subscriber at all OFDMA traffic channels.

4. The network defined in Claim 1 further comprising data rate storage for storing information indicative of the data rate of on-going traffic.

5. A method comprising:

determining frequency and spatial characteristics of a plurality of orthogonal frequency division multiple access (OFDMA) channels for a new subscriber and one or more subscribers with on-going traffic;

allocating a subscriber one or more OFDMA channels based on on-going traffic among the OFDMA channels.

6. The method defined in Claim a further comprising:

assigning OFDMA/space-division multiple-access(SDMA) traffic channels to multiple access subscribers based on broadband channel characteristics, wherein the broadband channel characteristics comprise space and frequency characteristics.

7. A method comprising:

estimating spatial and frequency characteristics of propagation channels using a FFT-based or parametric channel estimation algorithm between a base station and a new subscriber;

accommodating a rate request of the new subscriber by assigning OFDMA traffic channels that use a first amount of transmission power and cause a second amount of interference to co-channel subscribers.

8. The method defined in Claim 7 wherein estimating characteristics of propagation channels is performed using a FFT-based or parametric channel estimation algorithm.

9. The method defined in Claim 7 wherein the first amount comprises a minimum amount of transmission power as compared to other OFDMA channels not assigned to the new subscriber.

10. The method defined in Claim 7 wherein the second amount comprises the least amount of interference caused to co-channel subscribers in comparison to interference caused to one or more subscribers if using one

or more of the OFDMA traffic channels that are not assigned to the new subscriber

11. The method defined in Claim 7 wherein estimating spatial and frequency characteristics comprise estimating a spatial signature of the new subscriber over a predetermined number of OFDMA channels.

12. The method defined in Claim 11 wherein the predetermined number of OFDMA channels comprises all of the OFMA channels.

13. The method defined in Claim 7 further comprising determining an achievable rate of the new subscriber over each of the OFDMA channels with a presence of on-going subscribers.

14. The method defined in Claim 13 wherein determining the achievable rate is performed using spatial characteristics of on-going traffic and a spatial signature of the new subscriber over all of the OFDMA traffic channels.

15. The method defined in Claim 7 further comprising assigning, to the new subscriber, OFDMA traffic channels with the highest achievable rates and least effect on other subscribers with on-going traffic over some portion of the OFDMA channels.

16. A method of assigning orthogonal frequency-division multiple-access (OFDMA) traffic channels in conjunction with a space-division multiple access (SDMA) protocol comprising:

estimating broadband spatial and frequency channel characteristics of a requesting subscriber;

determining, for each of the OFDMA traffic channel, an achievable rate of the requesting subscriber over each of the OFDMA traffic channels;

calculating, for each of the OFDMA traffic channel, a new achievable rate of at least one other subscriber with on-going traffic on one or more of the OFDMA traffic channels if the at least one other subscriber is to share the one or more OFDMA traffic channels with the requesting subscriber;

determining candidate traffic channels; and

allocating candidate traffic channels to the requesting subscriber unit to satisfy the requested data rate.

17. The method defined in Claim 16 wherein determining the achievable rate of the requesting subscriber comprises using single-user detection or multi-user detection.

18. The method defined in Claim 16 wherein performing spatial multiplexing includes performing single-user beamforming and multi-user beamforming.

19. The method defined in Claim 16 wherein allocating candidate traffic channels comprises performing channel allocation based on reducing resource usage while satisfying the QoS requirements of the subscriber.

20. The method defined in Claim 19 wherein performing channel allocation is based on minimizing the resource usage.

21. A base station comprising:

a plurality of receiving antennas;

a plurality of down converters coupled to the plurality of receiving antennas;

a new accessing subscriber spatial signature register;

an on-going traffic spatial signature register; and

an OFDMA traffic channel allocator coupled to the new accessing subscriber spatial signature register and the on-going traffic spatial signature register.

22. The base station defined in Claim 21 wherein the channel allocation logic allocates OFDMA channels to a new subscriber based on information from the new subscriber spatial signature register and the on-going traffic spatial signature register.

23. The base station defined in Claim 21 wherein the channel allocator comprises

a first input for a two-dimensional (2-D) spatial signature of an accessing subscriber;

a second input for a requested data rate of the accessing subscriber;

a third input for data rates of on-going traffic in each of the plurality of OFDMA channels;

a fourth input for 2-D spatial signatures of on-going subscriber;

achievable rate calculation logic coupled to the first, second, third, and fourth inputs to calculate an achievable rate for the accessing subscriber over each of the OFDMA channels and calculates updated achievable rates of subscribers at each of the OFDMA channels with on-going traffic as if the accessing subscriber is added to said each of the OFDMA channels; and

channel selection logic coupled to the achievable rate calculation logic to select OFDMA channels, based on achievable rates, for use by the accessing subscriber to achieve the requested data rate.

24. The base station defined in Claim 23 wherein the channel selection logic does not allocate OFDMA channels in which calculated updated achievable rates are lower than actual rates of subscribers with on-going traffic.

25. The base station defined in Claim 21 wherein the channel allocator comprises

a first input for a two-dimensional (2-D) spatial signature of an accessing subscriber;

a second input for a requested data rate of the accessing subscriber;

a third input for data rates of on-going traffic in each of the plurality of OFDMA channels;

a fourth input for 2-D spatial signatures of on-going subscriber;

calculation logic coupled to the first, second, third, and fourth inputs to calculate signal-plus-interference to noise ratio (SINRs) for the accessing subscriber over each of the OFDMA channels and calculates updated SINRs of subscribers at each of the OFDMA channels with on-going traffic as if the accessing subscriber is added to said each of the OFDMA channels; and

channel selection logic coupled to the calculation logic to select OFDMA channels, based on SINRs, for use by the accessing subscriber.

26. The base station defined in Claim 23 wherein the channel selection logic does not allocate OFDMA channels in which calculated updated SINRs are lower than actual SINRs of subscribers with on-going traffic.

27. The base station defined in Claim 21 further comprising:

an OFDMA medium access control (MAC) logic coupled to the channel allocator;

an OFDM modulator coupled to the OFDMA MAC logic;

a plurality of parallel narrowband beamformers coupled to the OFDM modulation;

a plurality of upconverters coupled to the plurality of beamformers; and

a plurality of transmitting antennas coupled to the plurality of upconverters.